Alabama Department of Environmental Management

Yellow River Basin

Rivers and Reservoirs Monitoring Program

Lake Jackson
Intensive Basin Survey 2017

JACC-1: Approximate center of the lake, Covington County (30.99290/-86.32470).

BACKGROUND

The Alabama Department of Environmental Management (ADEM) began monitoring lake water quality statewide in 1985, followed by a second statewide survey in 1989. In 1990, the Reservoir Water Quality Monitoring Program [now known as the Rivers and Reservoirs Monitoring Program (RRMP)] was initiated by ADEM.

The current objectives of this program are to provide data that can be used to assess current water quality conditions, to identify trends in water quality conditions, and to develop Total Maximum Daily Loads (TMDLs) and water quality criteria. Descriptions of all RRMP monitoring activities are available in ADEM's 2017 Monitoring Strategy (ADEM 2017).

In 2017, ADEM monitored Lake Jackson as part of the intensive basin assessment of the Yellow River under the RRMP. This site was selected as representative of the lake. The purpose of this report is to summarize data collected in Lake Jackson (JACC-1) during the 2017 growing season (Apr-Oct). Monthly and/or mean concentrations of nutrients [total nitrogen (TN); total phosphorus (TP)], algal biomass/productivity [chlorophyll *a* (chl *a*); algal growth potential testing (AGPT)], sediment [total suspended solids (TSS)], and trophic state [Carlson's trophic state index (TSI)] from 2017 were compared to ADEM's historical data and established criteria.

In 2008, a consumption advisory was issued by the Alabama Department of Public Health for mercury in fish collected from Lake Jackson. As a result, Lake Jackson was first listed in 2010 and still remains on Alabama's 2020 Clean Water Act (CWA) §303(d) list of impaired waters for not meeting its water use classification.

Figure 1. Lake Jackson at JACC-1.

Figure 2. Map of Lake Jackson. No permitted discharges occur in the watershed (Table 1).

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Lake Jackson is classified as a *Swimming/Fish & Wildlife (S/F&W)* lake located in the Southern Pine Plains and Hills ecoregion (65f). Based on the 2006 National Land Cover Dataset, land use within the 2 mi^2 watershed is primarily open water (34%), hay/pasture, and open space (Figure 3). As of January 28, 2016, ADEM had issued no NPDES permits within the watershed.

SITE DESCRIPTION

Lake Jackson is a clear, naturally formed lake located on the Alabama-Florida border. It is approximately 350 acres in size with abundant aquatic vegetation. Lake Jackson has a mean bottom depth of 4.0 m (Table 2) at the sampling location.

METHODS

Water quality assessments were conducted at monthly intervals, April-October. All samples were collected, preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures (ADEM 2017), Surface Water Quality Assurance Project Plan (ADEM 2017), and Quality Management Plan (ADEM 2013).

Mean growing season TN, TP, chl *a*, and TSS were calculated to evaluate water quality conditions. Monthly concentrations of these parameters were graphed with ADEM's previously collected data to help interpret the 2017 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

Table 1: Summary of Watershed **JACC-1**

Basin		Yellow R
Drainage Area (mi^2)		2
Ecoregion[a]		65f
% Land use		
Open Water		34%
Developed	Open Space	14%
	Low Intensity	5%
	Medium Intensity	1%
	High Intensity	<1%
Forest	Deciduous Forest	4%
	Evergreen Forest	7%
	Mixed Forest	3%
Shrub/Scrub		5%
Hay/Pasture		16%
Cultivated Crops		2%
Wetlands	Woody	10%
# NPDES outfalls[b]	TOTAL	0

a. Southern Pine Plains and Hills

b. # NPDES outfalls downloaded from ADEM's NPDES Management System database, Jan 28, 2016.

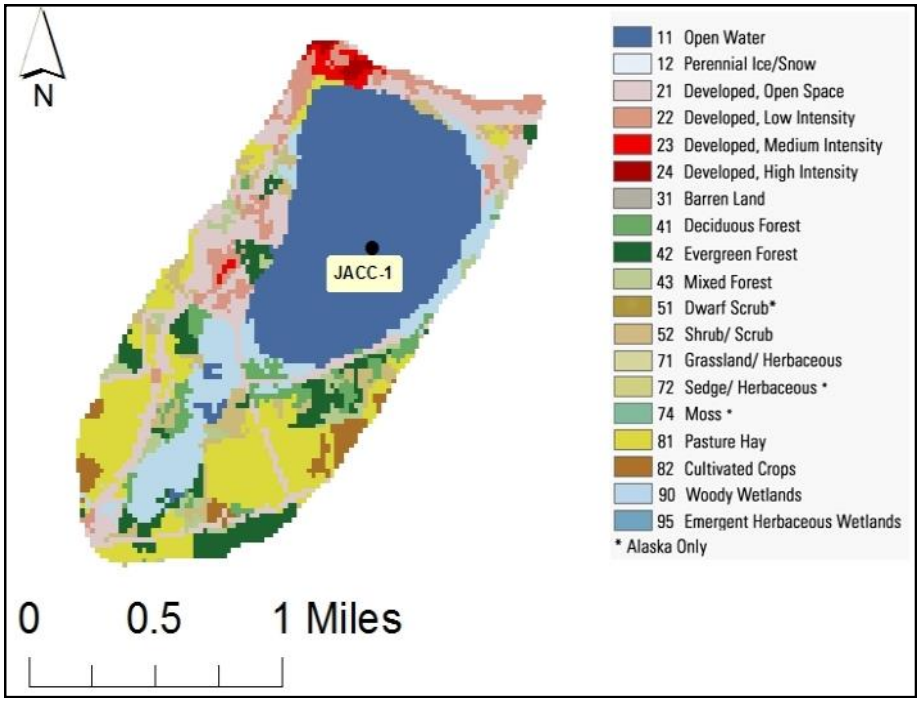


Figure 3. Land use within the Lake Jackson watershed at JACC-1.

RESULTS

The following discussion of results is limited to those parameters which directly affect trophic status or parameters which have established criteria. Results of all water chemistry analyses are presented in Table 2.

It is notable that heavy rainfall (>2") days prior to sampling could have contributed to the nutrient spike observed in May (Figure 4).

The mean growing season TN value decreased in 2017 from 2014 (Figure 5). Monthly TN concentrations spiked in May and decreased though October.

The mean growing season TP concentration in 2017 was low and similar to the previous two growing season means (Figure 5). Monthly TP concentrations were highest in May, but they were generally low all season.

In 2017, the growing season mean chl *a* value was the highest calculated mean in sampling history (Figure 5). Monthly chl *a* concentrations spiked to six times higher than average in May, which was the driving factor in the elevated overall season mean. However, the season mean was still below the growing season criteria of 7µg/L.

Mean TSI continued an increasing trend to a mesotrophic state in 2017 after showing a decline 2007-2012. Monthly TSI in Lake Jackson was primarily oligotrophic, but the lake reached mesotrophic conditions in April and August and eutrophic conditions in May (Figure 5).

The mean growing season TSS continued an increasing trend with a higher value in 2017 (Figure 6). Monthly TSS concentrations were highest in May.

AGPT was not collected in 2017.

DO concentrations met the ADEM criteria limit of 5.0 mg/L at 5.0 ft (1.5 m) for the entire 2017 sampling season (ADEM Admin. Code R. 335-6-10-.09) (Figure 7).

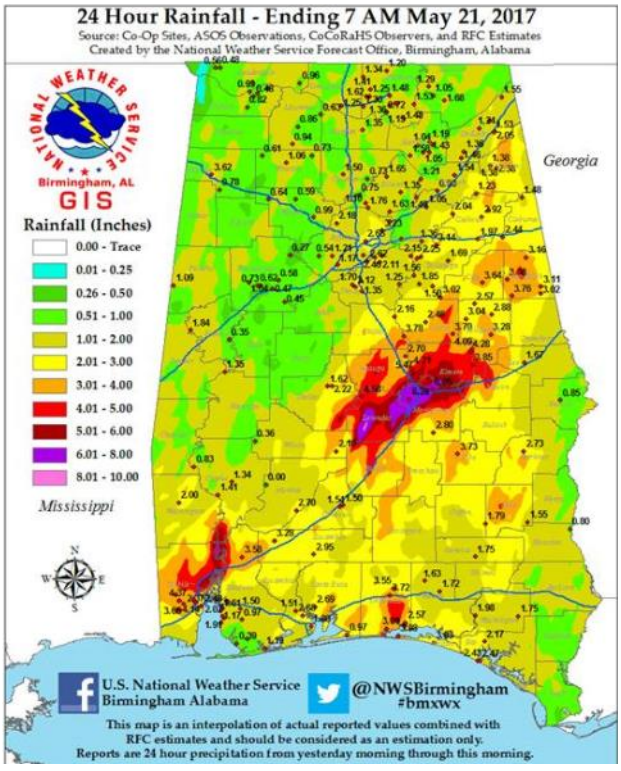
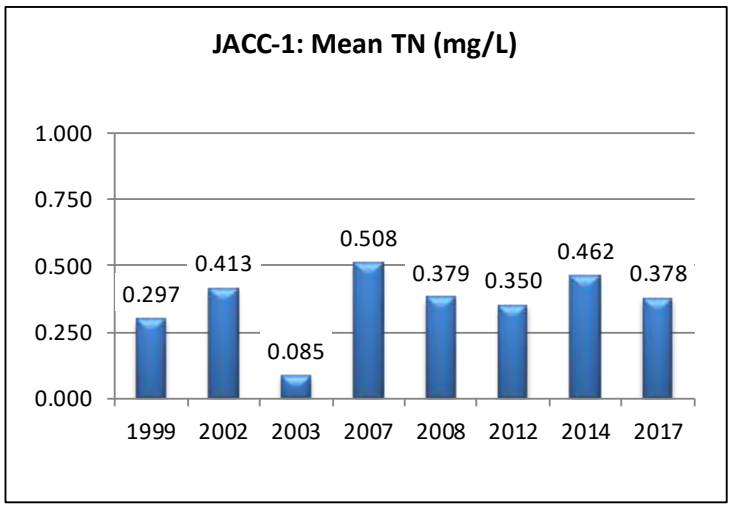
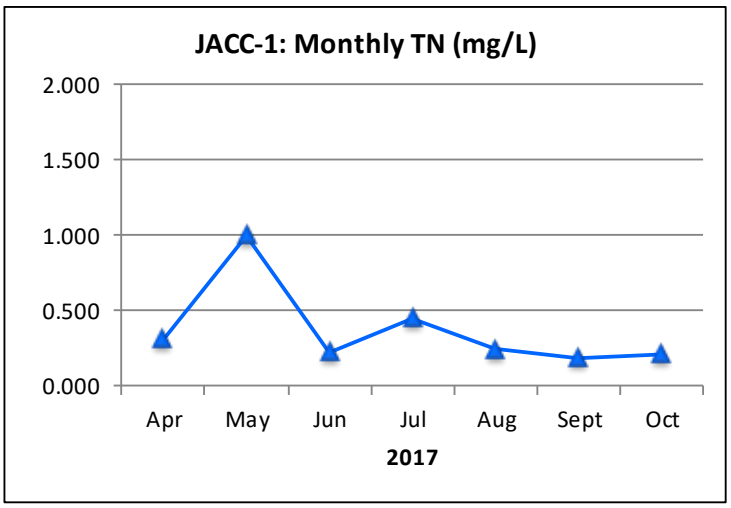
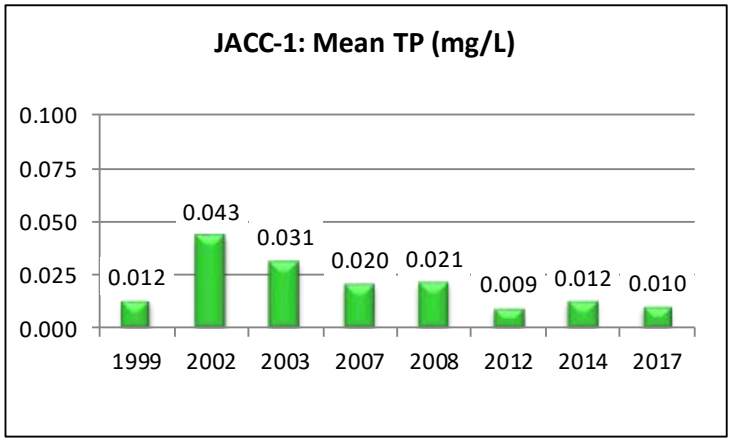
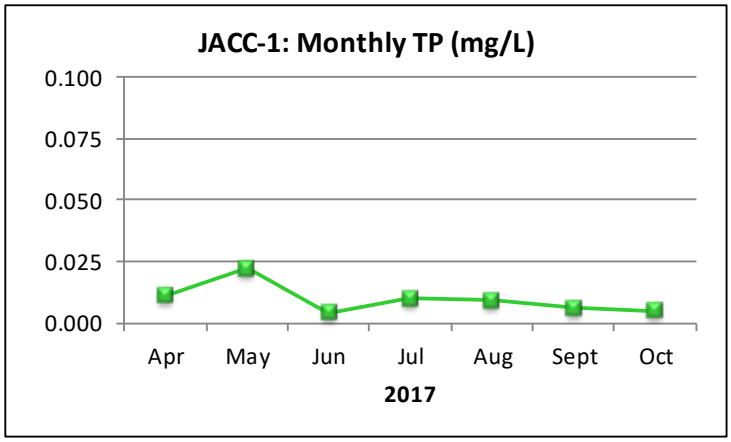


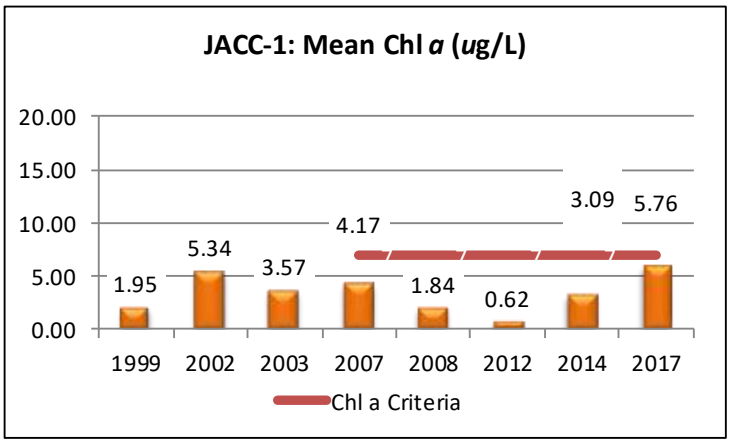
Figure 4. Significant rainfall event immediately prior to May sampling event.

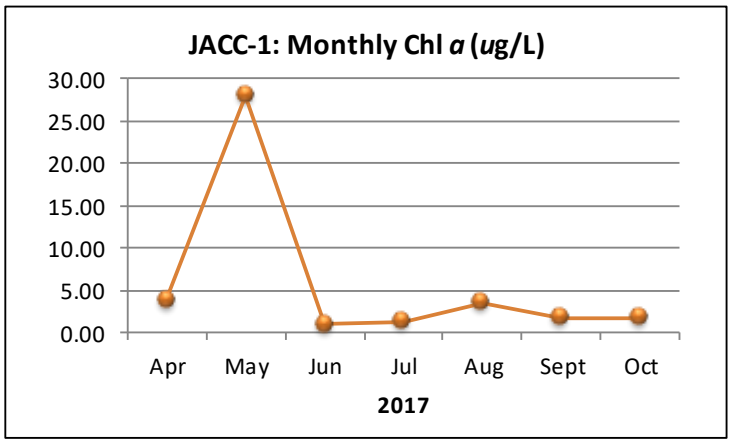


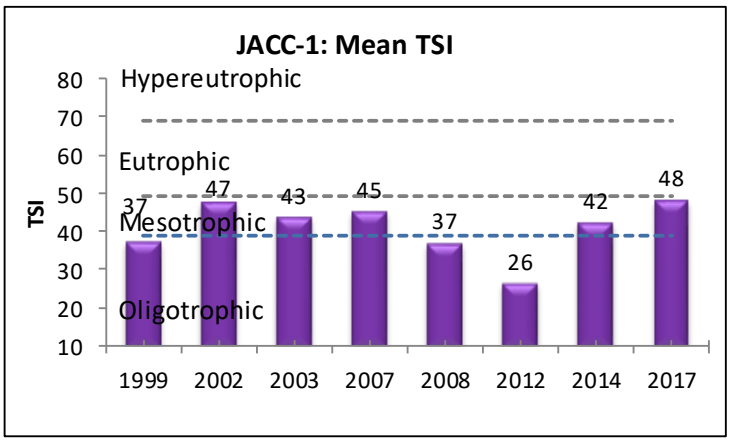












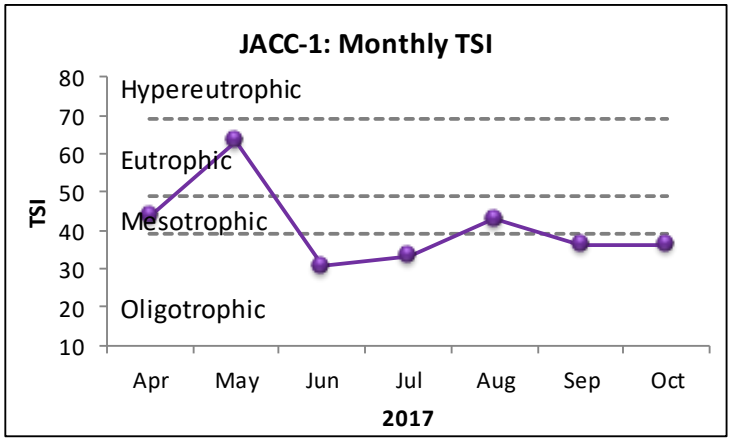
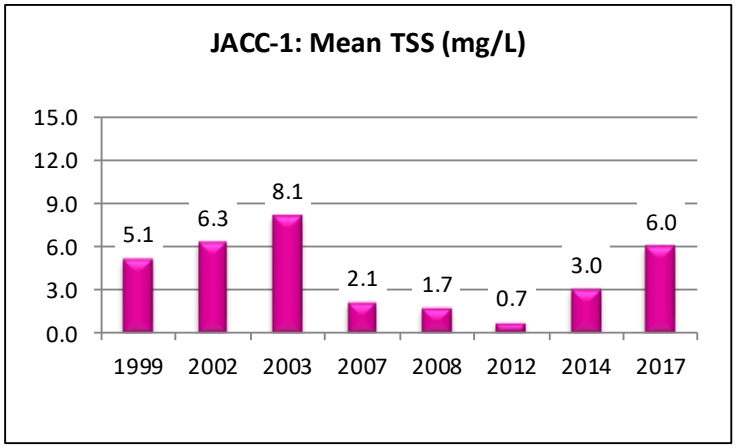


Figure 5. Mean growing season (1999-2017) and monthly (April-October, 2017) TN, TP, chl *a* and TSI measured in Lake Jackson. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.



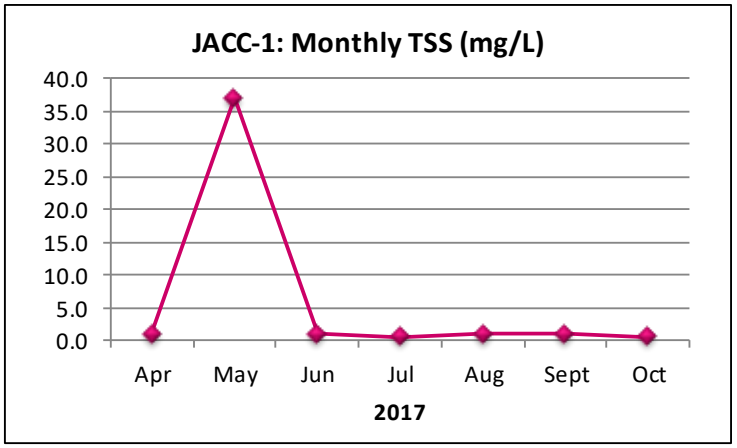


Figure 6. Mean growing season and monthly TSS measured in Lake Jackson.

Table 2. Summary of water quality data collected April-October, 2017. Minimum (Min) and maximum (Max) values calculated using minimum detection limits. Median (Med), mean, and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

JACC-1	N		Min	Max	Med	Avg	SD
Physical							
Turbidity (NTU)	7		1.4	23.7	1.6	5.8	8.4
Total Dissolved Solids (mg/L)	7		5.0	28.0	21.0	16.9	9.6
Total Suspended Solids (mg/L)	7	<	1.0	37.0	1.0	6.0	13.7
Hardness (mg/L)	4		7.4	8.2	7.8	7.8	0.3
Alkalinity (mg/L)	7		5.8	7.3	6.7	6.7	0.5
Photic Zone (m)	7		3.78	4.34	4.01	4.04	0.20
Secchi (m)	7		1.56	4.16	3.65	3.35	0.96
Bottom Depth (m)	7		3.8	4.3	4.0	4.0	0.2
Chemical							
Ammonia Nitrogen (mg/L)[J]	7	<	0.004	0.097	0.004	0.018	0.035
Nitrate+Nitrite Nitrogen (mg/L)	7	<	0.002	0.004	0.002	0.002	0.000
Total Kjeldahl Nitrogen (mg/L)	7		0.189	1.000	0.241	0.376	0.289
Total Nitrogen (mg/L)	7	<	0.191	1.001	0.243	0.378	0.288
Dis Reactive Phosphorus (mg/L)[J]	7	<	0.002	0.004	0.002	0.002	0.001
Total Phosphorus (mg/L)[J]	7		0.004	0.022	0.009	0.010	0.006
CBOD-5 (mg/L)	7	<	2.0	2.3	1.0	1.2	0.5
Chlorides (mg/L)	7		2.0	3.0	2.0	2.3	0.4
Biological							
Chlorophyll a (mg/m³)	7	<	0.10	28.00	1.78	5.76	9.89
E. coli (MPN/DL)[J]	4		1	3	1	2	1

J= one or more of the values is an estimate; N= # samples.

Table 3. Algal growth potential test results (expressed as mean MSC) dry weights of *Selenastrum capricornutum* in mg/L and limiting nutrient status. MSC values below 5 mg/L are considered to be protective in reservoirs and lakes (Raschke and Schultz 1987).

JACC-1	MSC	Limiting Nutrient
6/22/1999	1.52	Phosphorus
7/27/1999	2.03	Phosphorus
8/24/1999	1.45	None
9/2/2008	2.49	None
8/27/2014	3.46	Phosphorus
8/2017**	**Not collected	

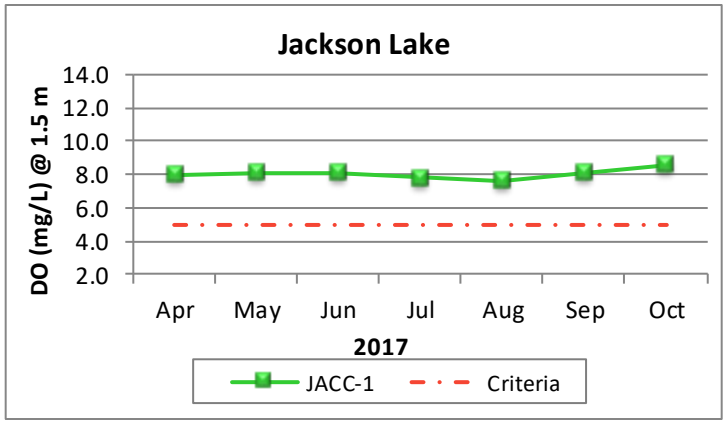


Figure 7. Monthly DO concentrations at 1.5 m (5 ft) for Lake Jackson collected April-October 2017. ADEM Water Quality Criteria pertaining to reservoir waters require a minimum DO concentration of 5.0 mg/L at this depth.

REFERENCES

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FOR MORE INFORMATION, CONTACT:
Ransom Williams Jr, ADEM Environmental Indicators Section
1350 Coliseum Boulevard, Montgomery, AL 36110
(334) 260-2715, rw@adem.state.al.us